LAMINATED BOARD FOR HIGH-FREQUENCY PRINTED CIRCUIT USE

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Abstract of **JP5136559**

PURPOSE:To obtain a metal foil-clad laminated board having low high-frequency loss in a high-frequency region. CONSTITUTION:Laminated board for high-frequency printed circuit use is formed by laminating insulating base materials of a dielectric dissipation factor of 0.01 or lower on the surface of metal foil which has a mean roughness of 2mum or smaller along the center line and the largest height of 8mum or lower. In this laminated board for high-frequency printed circuit use, the insulating base materials of a dielectric constant of 4 or lower are obtained by using a resin, such as a fluorine resin or a polyolefin resin, and the insulating base materials of a dielectric constant of 7 or higher can be obtained by using the above resin in combination with low-dielectric dissipation factor and high-dielectric powder, such as barium titanate ceramic. It is desirable that the thickness of the metal foil is 35mum or thinner.

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(54)【発明の名称】　高周波プリント回路用積層板

(57)【要約】

【目的】　高周波領域での、高周波損失のすくない金属箔張り積層板を得る。

【構成】　中心線平均粗さ（Ｒａ）が２μｍ以下、最大高さ（Ｒｔ）が８μｍ以下の表面性状の金属箔のこの表面に誘電正接が０．０１以下の絶縁基材を積層してなる高周波プリント回路用積層板。この高周波プリント回路用積層板において４以下の誘電率は樹脂がフッ素系樹脂又はポリオレフィン系樹脂などで得られ、７以上の誘電率は低誘電正接で高誘電体の粉末、たとえばチタン酸バリウム系セラミックスなどを併用することで得ることができる。また、前記金属箔の厚みは３５μｍ以下が好ましい。

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【特許請求の範囲】

【請求項１】　中心線平均粗さ（Ｒａ）が２μｍ以下、最大高さ（Ｒｔ）が８μｍ以下の表面性状を有する金属箔のこの表面に誘電正接が０．０１以下の絶縁基材を積層してなることを特徴とする高周波プリント回路用積層板

【請求項２】　請求項１の金属箔の厚みが３５μｍ以下であることを特徴とする請求項１記載の高周波プリント回路用積層板。

【請求項３】　請求項１の絶縁基材がフッ素系樹脂又はポリオレフィン系樹脂及び補強材を含む請求項１または、請求項２記載の高周波プリント回路用積層板。

【請求項４】　請求項１の絶縁基材がフッ素系樹脂又はポリオレフィン系樹脂及び補強材及び高誘電率で低誘電正接の微粒子状の誘電体を含む請求項１乃至請求項３記載の高周波プリント回路用積層板。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、高周波プリント回路板の形成に使用される金属箔張り積層板に関するものである。

【０００２】

【従来の技術】最近の電子工業、通信工業の各分野において使用される周波数が次第に高周波の領域に移行し、従来多用されていたキロヘルツ、メガヘルツから、ギガヘルツの領域になってきている。このような技術動向に伴い使用されるプリント配線板の基板材料は、ガラス基材エポキシ樹脂系積層板からポリオレフィン系やフッ素系樹脂を用いたものが使用されるようになっている。これらは特開昭60-239228号公報、特開平1-138238号公報、特開平1-138239号公報などに開示されている。しかし、前記絶縁基材と一体化される金属箔としては通常のガラス布基材エポキシ樹脂系などに用いている銅箔を流用しているに過ぎず、用いられている銅箔の表面性状はプリプレグと銅箔との接着性を上げるために銅箔表面は粗面に仕上げられており、中心線平均粗（Ｒａ）が３μｍ前後、最大高さ（Ｒｔ）が１０～１５μｍ程度である。この銅箔表面の粗化によって大きな高周波損失を起こすので改善が求められている。

【０００３】

【発明が解決しようとする課題】高周波領域において、高周波損失のすくない金属箔張り積層板を提供することにある。

【０００４】

【課題を解決するための手段】本発明は前記の課題解決に鑑みなされたものであり、その特徴は、中心線平均粗さ（Ｒａ）が２μｍ以下、最大高さ（Ｒｔ）が８μｍ以下の表面性状を有する金属箔のこの表面に誘電正接が０．０１以下の絶縁基材を積層してなる高周波プリント回路用積層板にある。

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【０００５】本発明の高周波プリント回路用積層板は、絶縁基材の表面に金属箔を積層してなる積層板や、この積層板を複数組み合わせた多層の積層板の構成でなる。

【０００６】誘電正接が０．０１以下の絶縁基材として、樹脂はフッ素系樹脂又はポリオレフィン系樹脂などを、基材はガラス繊維から作られるガラス布、ガラス不織布、ガラスマットなどが一般的であるが特に限定するものではなく、有機繊維の布、不織布、マットなどやこれらの複合材でもよい。好ましいのはより誘電正接の小さいものである。

【０００７】上記の構成によって絶縁基材として低誘電正接でかつ誘電率が４以下の小さいものが得られるが、装置の小型化など用途によっては誘電率が7以上の大きなものが求められる。高誘電率化する方法としては高誘電体の粉末を含有するのが好ましく、チタン酸バリウム系セラミックスなどを用いるのは低誘電正接でかつ高誘電率の絶縁基板を得るのに好適である。

【０００８】絶縁基材の表面に積層される金属箔としては、銅、ニッケル、アルミニウム、ステンレスなどの金属箔が、特には銅箔が電気伝導性の良好な点で好ましい。この場合、電解銅箔、圧延銅箔いずれでも良く特に限定するものではない。また、これら金属箔に回路を形成した金属箔を用いることもできる。これらいずれの場合にも使用される金属箔の厚みは３５μｍ以下が好ましく、薄いほど高周波プリント回路加工精度が良くなる。金属箔の中心線平均粗さ（Ｒａ）、最大高さ（Ｒｔ）が小さくなり接着性の低下が懸念される場合には、樹脂に適したカップリング剤を銅箔表面に施しておくのが望ましい。

【０００９】

【作用】高周波プリント回路において、高周波電流には表皮効果があって電流が電界の集中する基材側の面に集中するので金属箔の粗化は高周波信号に対しては抵抗分となるので、伝送線路としての導体損になり好ましくない。本発明では、金属箔の粗面程度を低減したことによって抵抗分が減少し、伝送線路としての導体損が少ない高周波プリント回路用積層板が得られる。

【００１０】

【実施例】以下、本発明を実施例によって具体的に説明する。

（実施例１）誘電正接が0.0002～0.0003のフッ素樹脂（ダイキン工業社製、PTFE）を溶融含浸したMIL 規格＃108 のガラス布10枚の外側に、中心線平均粗さ（Ｒａ）が１μｍ、最大高さ（Ｒｔ）が５μｍのマット面表面性状を有する３５μｍの銅箔のこの表面を重ねて配設し積層成形し、高周波プリント回路用積層板を得た。

（実施例２）誘電正接が0.001 ～0.002 のPPO 樹脂（GE社製、商標名ノリル）を溶融含浸したMIL 規格＃2116のガラス布4 枚の外側に、中心線平均粗さ（Ｒａ）が１μｍ、最大高さ（Ｒｔ）が８μｍのマット面表面性状を有

する１８μｍの銅箔のこの表面を重ねて配設し積層成形し、高周波プリント回路用積層板を得た。

（実施例３）誘電正接が0.0002～0.0003のフッ素樹脂（ダイキン工業社製、PTFE）にチタン酸バリウム５０重量%を含有させ、溶融含浸したMIL 規格＃108 のガラス布10枚の外側に、中心線平均粗さ（Ｒａ）が１μｍ、最大高さ（Ｒｔ）が5μｍのマット面表面性状を有する３５μｍの銅箔のこの表面を重ねて配設し積層成形し、高周波プリント回路用積層板を得た。

（比較例１）実施例１の樹脂含浸ガラス布の外側に、中心線平均粗さ（Ｒａ）が３μｍ、最大高さ（Ｒｔ）が１０μｍのマット面表面性状を有する３５μｍの銅箔のこの表面を重ねて配設し積層成形し、高周波プリント回路用積層板を得た。

（比較例２）実施例２の樹脂含浸ガラス布の外側に、中心線平均粗さ（Ｒａ）が１μｍ、最大高さ（Ｒｔ）が１＊

＊２μｍのマット面表面性状を有する３５μｍの銅箔のこの表面を重ねて配設し積層成形し、高周波プリント回路用積層板を得た。

【００１１】以上で得た、高周波プリント回路用積層板を用いて表面銅箔に回路を形成し、10GHz における共振周波数特性Ｑと、JIS-C6481 に基づいて誘電率を測定した。結果を表１に示した。

【００１２】表１から、実施例のプリント回路板は比較例のそれに比べ、Ｑ値は誘電正接の逆数にほぼ比例するのでＱ値が大きくなることは誘電正接が小さくなることで高周波領域において高周波損失のすくないことが、また、実施例１に比べ実施例３では高誘電率のプリント回路板の得られることが確認できた。

【００１３】

【表１】

	実施例１	実施例2	実施例3	比較例１	比較例２
銅箔の性状　Ｒａ Ｒｔ	１μｍ ５μｍ	１μｍ ８μｍ	１μｍ ５μｍ	３μｍ １０μｍ	３μｍ １２μｍ
Ｑ値	５１０	４５２	４４０	４８０	４００
誘電率	２．６	３．５	１０．５	２．６	３．５

【００１４】

【発明の効果】本発明によって、高周波領域において、高周波損失のすくない高周波プリント配線板用の金属箔張り積層板が得られる。

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(54) LAMINATED BOARD FOR HIGH-FREQUENCY PRINTED CIRCUIT USE

(57)Abstract:
PURPOSE: To obtain a metal foil-clad laminated board having low high-frequency loss in a high-frequency region.
CONSTITUTION: Laminated board for high-frequency printed circuit use is formed by laminating insulating base materials of a dielectric dissipation factor of 0.01 or lower on the surface of metal foil which has a mean roughness of 2μm or smaller along the center line and the largest height of 8μm or lower. In this laminated board for high-frequency printed circuit use, the insulating base materials of a dielectric constant of 4 or lower are obtained by using a resin, such as a fluorine resin or a polyolefin resin, and the insulating base materials of a dielectric constant of 7 or higher can be obtained by using the above resin in combination with low-dielectric dissipation factor and high-dielectric powder, such as barium titanate ceramic. It is desirable that the thickness of the metal foil is 35μm or thinner.

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CLAIMS

[Claim(s)]
[Claim 1] The laminate for RF printed circuits characterized by a dielectric dissipation factor coming to carry out the laminating of the 0.01 or less insulating base material to this front face of the metallic foil in which the center line average of roughness height (Ra) has 2 micrometers or less, and the maximum height (Rt) has the shape of front planarity 8 micrometers or less
[claim 2] The laminate for RF printed circuits according to claim 1 characterized by the thickness of the metallic foil of claim 1 being 35 micrometers or less.
[Claim 3] Claim 1 in which the insulating base material of claim 1 contains fluororesin or polyolefine system resin, and reinforcing materials, or the laminate for RF printed circuits according to claim 2.
[Claim 4] The laminate for RF printed circuits according to claim 1 to 3 with which the insulating base material of claim 1 contains the dielectric of the shape of a particle of the low dielectric dissipation factor in fluororesin or polyolefine system resin, reinforcing materials, and a high dielectric constant.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the metallic foil flare laminate used for formation of a RF printed circuit board.
[0002]
[Description of the Prior Art] The frequency used in each field of the latest electronic industry and communication link industry shifts to the field of a RF gradually, and is becoming the field of GIGAHERUTSU from the kilohertz currently conventionally used abundantly and a mega hertz. That for which the substrate ingredient of the printed wired board used in connection with such a technical trend used a polyolefine system and fluororesin from the glass base material epoxy resin system laminate is used. These are indicated by JP,60-239228,A, JP,1-138238,A, JP,1-138239,A, etc. however, the copper foil used for the usual glass fabric base material epoxy resin system etc. as a metallic foil united with said insulating base material is diverted -- **** -- the front face of the copper foil passed over which and used -- in order that description may raise the adhesive property of prepreg and copper foil, the split face is made to the copper foil front face, it is ********** (Ra) around 3 micrometers, and the maximum height (Rt) is about 10-15 micrometers. Since big RF loss is caused by roughening on this front face of copper foil, the improvement is called for.
[0003]
[Problem(s) to be Solved by the Invention] It is in offering the metallic foil flare laminate as for which RF loss becomes empty and which is not in a RF field.
[0004]
[Means for Solving the Problem] This invention is made in view of the aforementioned technical-problem solution, and that description is in the laminate for RF printed circuits with which a dielectric dissipation factor comes to carry out the laminating of the 0.01 or less insulating base material on this front face of the metallic foil in which the center line average of roughness height (Ra) has 2 micrometers or less, and the maximum height (Rt) has the shape of front planarity 8 micrometers or less.
[0005] The laminate for RF printed circuits of this invention becomes with the configuration of the laminate which comes to carry out the laminating of the metallic foil to the front face of an insulating base material, and the multilayer laminate which combined two or more these laminates.
[0006] Resin may not be limited especially although the glass fabric with which a dielectric dissipation factor is made from a glass fiber in fluororesin or polyolefine system resin as 0.01 or less insulating base material, a nonwoven glass fabric, the fiberglass mat of a base material, etc. are common, and the cloth, the nonwoven fabric, the mats, etc. and such composites of organic fiber are sufficient as it. The dielectric dissipation factor of desirable one is more small.
[0007] Although it is a low dielectric dissipation factor as an insulating base material and four or less small thing is obtained for a dielectric constant by the above-mentioned configuration, depending on applications, such as a miniaturization of equipment, seven or more big things are called for for a dielectric constant. It is desirable to contain the powder of a high dielectric as an

approach of forming into a high dielectric constant, a low dielectric dissipation factor uses barium titanate series ceramics etc., and it is suitable to obtain the insulating substrate of a high dielectric constant.
[0008] As a metallic foil by which a laminating is carried out to the front face of an insulating base material, metallic foils, such as copper, nickel, aluminum, and stainless steel, are especially desirable at a point with copper foil good [electrical conductivity]. in this case, electrolytic copper foil and rolling copper foil -- any are especially sufficient and it does not limit. Moreover, the metallic foil in which the circuit was formed can also be used for these metallic foils. RF printed circuit process tolerance becomes good, so that the thickness of the metallic foil which is used in any [these] case has desirable 35 micrometers or less and it is thin. When the center line average of roughness height (Ra) of a metallic foil and the maximum height (Rt) become small and we are anxious about an adhesive fall, it is desirable to give the coupling agent suitable for resin to a copper foil front face.
[0009]
[Function] since it concentrates on the field by the side of the base material which electric field concentrate [a current] and roughening of a metallic foil becomes a resisted part to a RF signal in a RF printed circuit by there being the skin effect in the high frequency current -- the conductor as the transmission line -- it is lost and is not desirable. having reduced split-face extent of a metallic foil in this invention -- a resisted part -- decreasing -- the conductor as the transmission line -- the laminate for RF printed circuits with little loss is obtained.
[0010]
[Example] Hereafter, an example explains this invention concretely.
(Example 1) MIL to which the dielectric dissipation factor carried out melting sinking in of the fluororesin (the Daikin Industries, LTD. make, PTFE) of 0.0002-0.0003 Specification #108 the mat side front face whose center line average of roughness height (Ra) is 1 micrometer and whose maximum height (Rt) is 5 micrometers on the outside of ten glass fabrics -- this front face of the 35-micrometer copper foil which has description was arranged in piles, arkd carried out laminate molding, and the laminate for RF printed circuits was obtained.
(Example 2) a dielectric dissipation factor -- 0.001-0.002 PPO MIL which carried out melting sinking in of the resin (the product made from GE, brand-name noryl) Glass fabric 4 of specification #2116 the mat side front face whose center line average of roughness height (Ra) is 1 micrometer and whose maximum height (Rt) is 8 micrometers on the outside of ** -- this front face of the 18-micrometer copper foil which has description was arranged in piles, and carried out laminate molding, and the laminate for RF printed circuits was obtained.
(Example 3) MIL which the dielectric dissipation factor made the fluororesin (the Daikin Industries, LTD. make, PTFE) of 0.0002-0.0003 contain 50 % of the weight of barium titanate, and carried out melting sinking in Specification #108 the mat side front face whose center line average of roughness height (Ra) is 1 micrometer and whose maximum height (Rt) is 5 micrometers on the outside of ten glass fabrics -- this front face of the 35-micrometer copper foil which has description was arranged in piles, and carried out laminate molding, and the laminate for RF printed circuits was obtained.
(Example 1 of a comparison) the mat side front face whose center line average of roughness height (Ra) is 3 micrometers and whose maximum height (Rt) is 10 micrometers on the outside of the resin sinking-in glass fabric of an example 1 -- this front face of the 35-micrometer copper foil which has description was arranged in piles, and carried out laminate molding, and the laminate for RF printed circuits was obtained.
(Example 2 of a comparison) the mat side front face whose center line average of roughness height (Ra) is 1 micrometer and whose maximum height (Rt) is 12 micrometers on the outside of the resin sinking-in glass fabric of an example 2 -- this front face of the 35-micrometer copper foil which has description was arranged in piles, and carried out laminate molding, and the laminate for RF printed circuits was obtained.
[0011] A circuit is formed in surface copper foil using the laminate for RF printed circuits obtained above, and it is 10GHZ. The resonance frequency property Q and JIS-C6481 which can be set It was based and the dielectric constant was measured. The result was shown in Table 1.

[0012] the thing to which as for the printed circuit board of Table 1 to an example RF loss likes [a dielectric dissipation factor] that Q value becomes large in a RF field by becoming small since Q value is proportional to the inverse number of a dielectric dissipation factor mostly compared with it of the example of a comparison and which nothing is -- moreover, compared with the example 1, it has checked that the printed circuit board of a high dielectric constant was obtained in the example 3.
[0013]
[Table 1]

	実施例1	実施例2	実施例3	比較例1	比較例2
銅箔の性状 Ra	1μm	1μm	1μm	3μm	3μm
Rt	5μm	8μm	5μm	10μm	12μm
Q値	510	452	440	480	400
誘電率	2.6	3.5	10.5	2.6	3.5

[0014]
[Effect of the Invention] The metallic foil flare laminate for RF printed wired boards which RF loss likes in a RF field by this invention and which is not is obtained.

[Translation done.]